EFFECT OF CAGE DIMENSIONS ON THE ADULT SIZE SELECTION IN *AEDES ALBOPICTUS*

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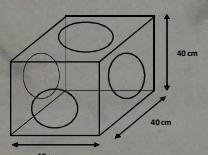
INTRODUCTION

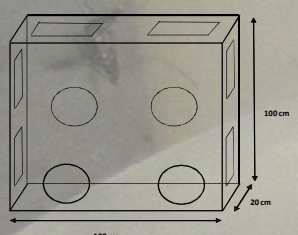
The capacity to mass-rear "good quality" males is of fundamental importance for the success of Sterile Insect Technique (SIT) against any pest or vector species. It is known that artificial rearing conditions strongly influence the fitness of the reared insects throughout selective processes and that adaptive phenomena may take place soon following the colonization with evident impact over few generations.
This experiment was focused on determining how strongly the size of the cage, a parameter which is under research in the mass-rearing of mosquitoes, could influence the fitness of reared adults during 20 generations.
The effect of colonization in three differently sized cages on the wing length, egg production and adult survival of *Aedes albopictus* (Skuse, 1895) was investigated. The wing length was selected as an easy parameter to measure morphological variable which is well correlated with the fitness of reared male mosquitoes.

C1
1,280 adults
40 x 40 x 40 cm
volume 64 liters



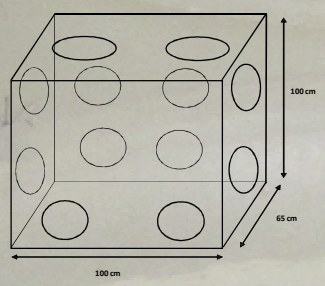
1 pupae plate
2 egg cups
1 sugar feeder
1 blood feeder

C2
4,000 adults
100 x 20 x 100 cm
volume 200 liters



4 pupae plates
6 egg cups
3 sugar feeders
3 blood feeders

C3
13,000 adults
100 x 65 x 100 cm
volume 650 liters



13 pupae plates
20 egg cups
10 sugar feeders
10 blood feeders

MATERIALS AND METHODS

Three Plexiglas cages (C1, C2 and C3) for mosquito adult rearing were used for the experiment. The cages contained several devices (pupae plates, egg cups, sugar feeders, blood feeders) in different number depending on the cage size.
The three lines were started from wild collected eggs and maintained for 20 generations under laboratory conditions in a climate-controlled room (28±1°C, 80% RH and a photoperiod of 14:10 L:D). At each generation the cages were emptied and the new generation was started with the same number of pupae to have the same adult density in all cages which was kept at 20 adults/liter of cage volume, with the sex ratio of about 1:1. The adults housed in each cage were obtained from pupae collected on the third day from pupation onset. An open source image processing and analysis program (ImageJ) was used for the measurement of the wings (by the linear method) and for egg counting.


pupae plates


egg cups


sugar feeder


blood feeder

WING LENGTH

A sample of 50 males and 50 females was collected from each cage at each generation, killed and stored at -20°C for wing measurement. The standard wing measurement is defined as the length from the axillary incision (or alula notch) "Al" to the tip of the wing (excluding the fringe scales) between veins "R3" and "R4+5".

EGG PRODUCTION

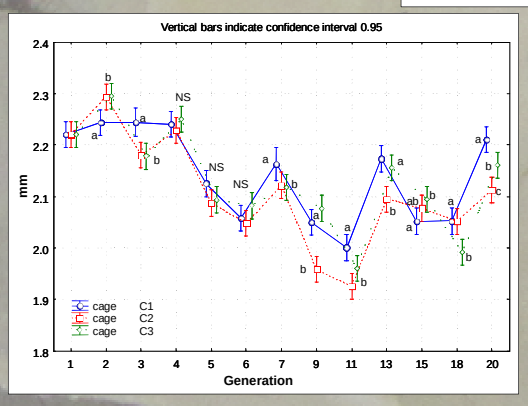
The mean number of eggs laid per female, for each cage, was determined by dividing the total number of eggs produced per cage with the total number of females in that cage (assuming that all the females blood fed and laid eggs). The total number of females (and males) was based on the sex ratio calculated at the beginning of each generation.

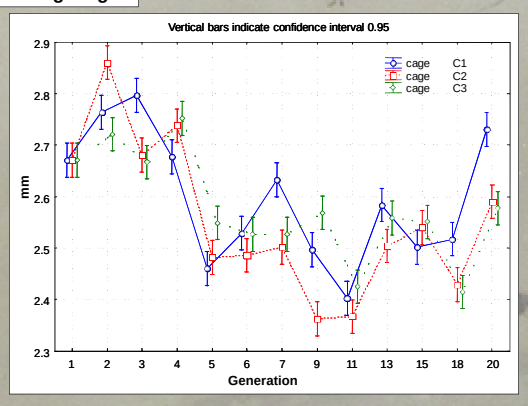
ADULT SURVIVAL

At the end of each generation (15 days after pupae introduction in each cage) all alive mosquitoes were aspirated and counted. The survival rate was estimated by comparison of the number of mosquitoes alive and the total number of mosquitoes introduced in each cage for each generation.

RESULTS

Male and Female wing length



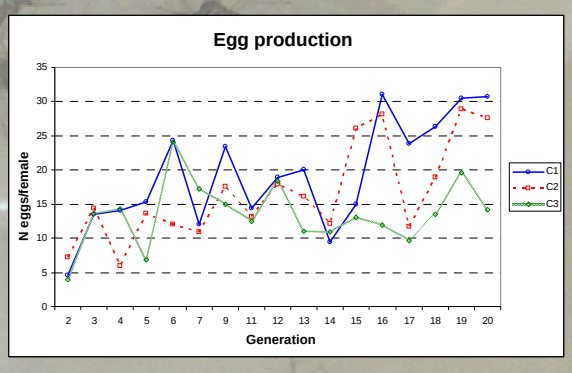


WING LENGTH

The wing length showed an initial tendency to increase both in males (in C2 and C3) and females (in C1 and C2) then a decline was observed in all cages for both males and females up to the generation F_{10}, when an increase started up to the generation F_{20} in all cages.
The mean wing length of generation F20 was similar to the initial population in all cages. Significant difference in wing length was found between cages for males, but not for females. A tendency for an increase in wing length in the small cage (C1) was observed for both males (significant difference from C2 and C3) and females (no significant difference from C2 and C3).

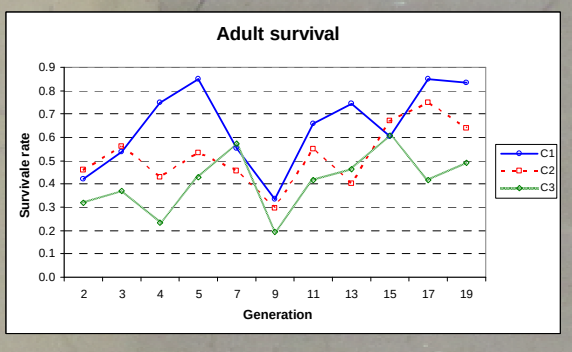
EGG PRODUCTION

The number of eggs per female (fecundity) showed a trend of increasing during the 20 generations period in cages C1 and C2. The average fecundity in cage C3 was significantly lower than in cages C1 and C2 from generation F_{12} to generation F_{20}, while no significant difference was observed in cage C1 vs cage C2 during the same period.



ADULT SURVIVAL

The adult survival showed an initial increase (particularly in cage C1) followed by a decline (in all cages) up to the generation F_9. No significant differences were observed among the cages in this period. From generation F_{10} adult survival started to increase in all cages up to F_{20}, when significant difference was found between C1 and C2 vs C3.
The mean adult survival in the 20 generations period was significantly higher in cage C1 vs C2 and C3, while no significant differences were observed between C2 and C3.



CONCLUSIONS

The mosquito adult rearing in laboratory cages produced an adaptation which caused a decrease followed by an increase in the wing size and in the adult survival rate in all cages.
Surprisingly the male wing size in C1 (small cage) resulted higher than in C2 and C3. Similar evidence was observed on females even if not significant differences were found.
The average fecundity increased through the observed period of 20 generations showing an adaptation of the females to the cage (more evident in cages C1 and C2).
The adult survival resulted significantly higher in cage C1 compared to the other two cages.
Results showed that the smaller cages (C1 and C2) induced better adaptations in mosquito wing length, adult survival and fecundity suggesting their suitability for mass rearing.

AKNOWLEDGEMENTS
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